Supplementary Materials

Pilot Project A: Initial Steps for Integrated Earthquake Scenario Development	
Project region	Southwest Puerto Rico
Project leads	Yolanda Lin (University of New Mexico), Elizabeth Vanacore (University of Puerto Rico at Mayagüez), Surya Pachhai (University of Utah), and Kristine Pankow (University of Utah)
Partners	Puerto Rico Seismic Network; Puerto Rico Emergency Management
Description	Earthquake scenarios are important tools for anticipating the potential impacts from specific earthquakes. Scenarios have been used within emergency management communities for response and recovery exercises and as tools to identify potential impacts to built structures and the overall risk in communities. While earthquake scenarios have been utilized within specific user groups for many years, communicating the importance and impact of the scenarios outside of these specific groups to the wider community is less-well-developed. This pilot project asked the research question: how can we generate integrated earthquake scenarios? By integrated, we mean how we combine the physical science observations related to fault source, wavefield propagation and amplification, secondary hazards like liquefaction, rockfall with the impact to the built environment, and societal impacts within the framework of collective impact. How do we use these scenarios to better meet the needs of a wider community? To start addressing this question, we needed to identify the contributions to response, recovery, and resiliency that communities (emergency managers, engineers and municipal, and local stakeholders) find valuable. We also needed to identify how to best engage with communities for this information to make a significant impact. Project activities included: (1) Developing a questionnaire to determine what consequences of the scenario matter to impacted communities (2) Measuring the average shear velocity in the upper 30 m (Vs30) in southwest Puerto Rico and (3) Identifying and compare strategies for engaging communities to participate in Vs30 data collection and scenario development.
Example of how CI core principles were applied	Project A leveraged regular meetings and interviews (continuous communication) to identify priority locations and impacts for developing future integrated earthquake scenarios (Common Agenda). Team members based in Puerto Rico engaged in additional activities such as the Shakeout, talks, Caribe Wave, and Instagram to further engage with community members (Mutually Reinforcing Activities). A student training workshop (Mutually Reinforcing Activity) on spatial autocorrelation (Shared Measurement) was organized by project leads at the University of Utah and made available over Zoom as an additional means of collaboration across the center.
Pilot Project B: Central and Eastern US Collaborative for Community Earthquake Science and Hazard Mitigation	
Project region	Central and Eastern United States
Project leads	Alan Kafka (Boston College), Susan Bilek (New Mexico Tech), John Ebel (Boston College), Steven Jaume (College of Charleston), Zhigang Peng (Georgia Tech), and Conevery Bolton Valencius (Boston College)
Partners	Community scientists with a Raspberry Shake
Description	The Central and Eastern United States (CEUS) is a high-consequence, low frequency of incidence (HiC-LoFI) region with zones of moderate earthquake activity compared to that of plate boundary regions. Given the complex seismotectonics of this intraplate region, the Central and Eastern United States earthquake hazard is generally not well understood. This makes it particularly challenging to explain to local populations why scientists think these communities should be concerned about earthquakes in their region. And yet, moderate-size to large and damaging earthquakes, with strong ground shaking felt over wide areas, have occurred in this region, such as in: Cape Ann, MA (1755, M$\sim$6.2), New Madrid, MO (1811-1812, M$\sim$7.1, 7.2), and Charleston, SC (1886, M$\sim$7.0). Although seismologists are still only at the very early stages of understanding why these earthquakes occur where they do, people in impacted communities want honest and reliable answers from seismologies on the "state of the art" understanding of why they are occurring and what their implications are for living in the Central and Eastern United States. Project activities included targeted studies of currently active seismicity in this region using data largely from low-cost community seismographs. Fundamental earthquake science questions we aimed to address included: How are intraplate earthquakes different from plate boundary earthquakes? How are intraplate earthquakes related to mapped faults and other pre-existing structures? Is the spatial pattern of seismicity in intraplate regions generally persistent over time? In addition, community science partners operating these low-cost instruments experience real science, and hence become more scientifically educated citizens, with an improved understanding of science-based public policy issues.

Example of how CI core principles were applied	Pilot Project B developed relationships with community organizations and interested individual community scientists to identify priorities for which faults to focus on and for where the low-cost seismographs could be installed (Common Agenda). Community engagement through updates about recent earthquakes, attendance at community meetings (e.g., at libraries and schools) (Continuous Communication) also supported additional ways to engage new groups and individuals in earthquake science (Mutually Reinforcing Activities).
Pilot Project C: Refining the Scenario for the East Franklin Mountain Fault (EFMF) Hazard in El Paso, TX	
Project region	El Paso, Texas
Project leads	Aaron Velasco (University of Texas at El Paso), Jeffrey Weidner (University of Texas at El Paso), Jose Hurtado (University of Texas at El Paso), Marianne Karplus (University of Texas at El Paso), and Eric Jones (University of Texas Health Science Center Houston)
Partners	El Paso Office of Emergency Management, University Medical Center
Description	This project aimed to refine estimates of the seismic hazard associated with the East Franklin Mountains Fault (EFMF), which transects the cities of El Paso, TX and Ciudad Juárez, Chihuahua, MX, and to communicate our results for earthquake planning with the local office of emergency management. The East Franklin Mountains Fault has a low probability of earthquake occurrence, yet an earthquake on that fault could have a high impact on the local, bi-national population. Recent earthquakes in west Texas have been felt in El Paso, TX and generated new interest in earthquakes, their origins, and their hazards in the community. We partnered with community organizations to receive their direct input into the scope of the research and to jointly organize community events. One of our partners was the University Medical Center (UMC, the only Trauma 1 center in this region) who have had keen interest in earthquake hazards since 2022 when their buildings shook during an M5.4 earthquake in west Texas, over 200 miles away. We conducted site surveys and seismic analyses to determine the shallow to deeper basin structure in this area to understand why the M5.4 earthquake was felt on the UMC campus. To evaluate site response across the El Paso region, we analyzed data from a 50-station nodal deployment (recording for 2 weeks) and a 6 station broadband deployment (recording for 6 months) across El Paso. Tromino© surveys were also conducted to obtain noise measurements at over 200 sites throughout the city (Ayala Cortez et al.). To increase preparedness, we attended emergency planning meetings for El Paso hospitals as well as other emergency managers to discuss earthquake hazards. We were also invited to continue working with them to develop a scenario-driven tabletop exercise. Finally, we engaged numerous local schools in our first ShakeOut drills in October 2023 and 2024.
Example of how CI core principles were applied	The project was managed by the team at UTEP (Centralized Support), who kept in regular contact with partners (Continuous Communication). Both the UTEP team and the community partners planned and initiated planning activities during the course of the project (Mutually Reinforcing Activities). Activities and project products were evaluated based on number of people reached, quality of event/content, and publication/dissemination of outcomes (Shared Measurement).
Pilot Project D: Crowdsourcing Approaches to Building Inventory Development	
Project region	El Paso, Texas
Project leads	Jeffrey Weidner (University of Texas at El Paso), Aaron Velasco (University of Texas at El Paso), and Marianne Karplus (University of Texas at El Paso)
Partners	Harmony School of Science
Description	This project focused on establishing a relationship with a local school in order to address two specific goals. First, we engaged with the local community about seismic hazard, risk mitigation, and preparedness by partnering with a classroom and cohort of students over the full duration of the project – a school year. Second, we wanted to understand how crowdsourcing can support development of building inventory in high impact, low probability seismic regions. The project focused on developing a custom FEMA Rapid Visual Screening application through a gamification strategy and establishing a partnership with Harmony School of Science in El Paso, TX. Activities included: (1) designing a data collection instrument to assess students' baseline awareness of seismic hazards and seek Institutional Review Board approval; (2) maintaining a weekly classroom presence, built rapport, collected initial data, and adapted lessons to student learning styles. (3) students participating in a crowdsource data collection classroom competition and (4) organizing a school-wide participation in the Great ShakeOut to celebrate their contributions to citizen (community) science.

Example of how CI core principles were applied	The CI framework was applied to Pilot Project D first through an initial meeting to establish a shared understanding of the project's goals and potential (Common Agenda). The researchers were interested in raising awareness of earthquake hazards through a fun, gamified approach with elementary school students. At the same time, the community partners were excited to partner with the University and to bring outside STEM professionals into the classroom (Mutually Reinforcing Activities). The primary struggle in applying CI to Pilot Project D centered on Continuous Communication. After initial contact was established, communication became sparse, owing primarily to the novelty of the partnership and the research team's desire not to "become a bother" to the community partner—a desire born of respect for the partner's competing priorities. This communication breakdown hampered our ability to enact our agenda and conduct shared measurement.

Table S.1. Illustrative descriptions of the four C-CIES pilot projects. Note that these are not a complete summary of all activities that encompassed each project.

References

Ayala Cortez, S., Velasco, A., Karplus, M., and Doser, D. Amplification and Spectral Ratio Analysis in El Paso, Texas. *In Prep*.